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AUTHOR Hill, Margaret H.; Stephens, Liz C.
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ABSTRACT

This case study describes how one autistic learner, an 11-year-old boy, became a co-researcher with university literacy instructors to investigate how hypermedia can help him develop language and literacy skills. Data was collected for one year from video taping, journal notes, interviews with teachers and parents, test scores, and student artifacts of reading and writing samples. Researchers learned that fast-paced behavioral games were a detriment to learning language processes, whereas talking books on CD-ROM, schematic mapping software, and simulations helped the learner to increase reading and writing competencies. The learner's scores doubled every six months in reading and writing. (Contains 17 references.) (Author/AEF)

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David's Story: How Technology Helped a Severely Disabled Learner Read and Write

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Margaret H. Hill
University of Houston-Clear Lake, USA
hillp@uhcl.cl.uh.edu

Liz C. Stephens
Southwest Texas State University, USA
lcs@tenet.edu

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Abstract: This case study describes how one autistic learner became a co-researcher with university literacy instructors to investigate how hypermedia can help him develop language and literacy skills. Researchers learned that fast paced behavioral games were a detriment to learning language processes whereas books on tapes, schematic mapping software, and simulations helped the learner increase reading and writing competencies. The learner's scores doubled every six months in reading and writing.

How Can Hypermedia Help Autistic Learners?

Autism and what specifically was identified by Leo Kanner (1943) and Hans Asperger (1944) is a syndrome which has led educational specialists searching for a variety of instructional strategies to help the autistic learner acquire literacy. Due to the insular nature of this syndrome, language development and the subsequent learning of reading and writing are problematic. Language is acquired through a complex multiplicity of social stimuli. Yet, the very nature of the autistic individual prevents this necessary social interaction and the response mechanisms needed to produce language and literacy. The autistic learner, according to Kanner (1943) is alone, obsesses on sameness and has a literal mind. In this case study, literacy researchers hypothesized that a hypermedia platform might be a suitable mechanism for stimulating the development of language growth in one autistic learner (Rouet & Levonen, 1996; Spiro, Feltovitch, Jacobson, & Coulson 1991; Sprio, Coulson, Feltovich, & Anderson, 1988).

Hypermedia provides a platform which can be conducive to language growth for autistic learners. It is nonbiased, can be highly repetitive, is based upon pattern generations, and provides multiple links to senses through visual, tactile, and auditory senses. It is interactive, infinitely patient yet provides pathways for multiple ways of knowing and learning. Spiro, Feltovitch, Jacobson, and Coulson (1991) claimed that "revisiting the same materials at different times, in rearranged contexts, for different purposes and from different conceptual perspectives is essential for attaining the goals of advanced knowledge acquisition"(p.28). Spiro et al contend that hypertext provides a platform for cognitive flexibility and therefore allows the learner to create his own learning pathways. In addition, the flexible branching and multiplicity of information platforms provides the autistic learner avenues of learning that were heretofore not available. Multiple options such as larger print, audio and visual simulations, rebus symbols, live motion examples and multiple branching options all enhance the learner as new vocabulary and concepts link to the existing schema. In this study, one autistic learner's pathways to learning literacy are described. Past studies (Heimann, Nelson, Tjus, & Gillberg, 1995; Mykelbust, 1995; O'Conner & Hermelin, 1994; Proco, 1989; Prizant, 1996) of autistic learners describe and document the autistic learner's acquisition of word recognition alone. However, no studies systematically explain the acquisition of processes involved in reading comprehension, of retellings, and of story and information writing. This is the story of one autistic learner's journey into hypermedia and increased literacy acquisition.

Stumbling Blocks to Literacy and Why Hypermedia May Free this Roadblock

Reading and writing is a social phenomena based initially on the development of the speaking and listening processes already acquired through social interactions—talking and listening to others. However, if these connections are never firmly acquired as they are not in the autistic learner, then how

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can reading and writing proceed? Reading is the recognition of a writer's message—it is listening to that writer's voice. Writing is the connection in writing to an abstract audience—to those unknown or known audiences. In addition, the abstract symbol system of writing and reading adds an additional confounding variable. Because autistic learners are inward and do not connect socially, it is very difficult for them to learn to read and write (Frith, 1989; Myklebust, 1995; Prizant, 1996; Sigman, Yirmiya, Capps, 1995). However, if they can begin to connect their wonderings to information that is available over hypermedia which is presented with a multiplicity of presentations both audio and visual, then how can this literacy acquisition occur? Most of the writing produced over the internet is information—not narrative story. Fact laden information is presented without feelings and abstract beliefs and thus, might be a more connective process for autistic learners. The autistic learner according to researchers (Grandin, 1995; Happe & Frith, 1995; and Harris, 1995; Tager-Flusberg, 1996) might be able to read and comprehend hypermedia and internet platforms far more effectively than reading books and stories. Thus, hypermedia and internet learning may be an avenue that is a perfect platform for the autistic learner who is grounded in repetitiveness, rigidity, and singlemindedness.

The Study

A year of data were collected from video taping, journal notes, interviews with teachers and the parents, test scores and student artifacts of reading and writing samples. David, an eleven year old boy, came to our office every week for one to two hour sessions. The purpose of the study was to explore his literacy growth through a hypermedia environment. He was asked to be the scientist along with us and together we explored software that would help him grow in literacy and learn important information also. Thus, David became a co-investigator with us and was very aware that we were investigating software that would enable him to advance his knowledge in many fields of learning.

Initially, he brought in software that he had at home. These were games that he played. He proudly showed us the components of each game and how he played the game. He was never able with these platforms to tell us the main purpose, to predict, or explain what concepts he had gained. These games were all behavioral in nature; to David, trial and error was the main strategy; and it never seemed to bother him if he won or not. However, we did notice that he used the characters' names of his "game" software as he wrote his initial stories on Story Weaver (MECC). As a result, these first stories were very disjointed with names attached to actions that did not make sense.

However, they did make an impression on him. It is interesting to note that David's first stories used characters and actions that he learned from these game formats but he was never able to make real sense of them as he was later able to do from retellings of CDROM talking books. For example, he drew a picture of a stage and actors and then wrote, "Spy Fox saved Mr. Othery with his toothbrush. He had a steel door and his toothbrush was on the steel door on the handle. Then those bad crabs were coming after him." With much of the game platform, David viewed the isolated parts, but never connected the whole.

My reflections from my journal were as follows.

> With this software, David, responds but seemingly without thinking why. He also doesn't seem to have a strategy as he tries one avenue, and then another. The episodes of these software pieces are very short, very reactive, and not enduring. For example, David takes the red car through a series of adventures where he must choose one pathway or another. Depending upon his decision for pathways, his car ends in a ditch or on a road to another adventure. Quick actions and reactions are necessary. As I sat and asked him questions, David was never able to tell me what he was really doing, what was the point of this game, or how it was played. He had many isolated reactions and comments, 'Look!', 'Oh!' 'Get him!' That was it. There was never an explanation on David's part. He never questioned why or tried to compare it to something in his own life or other learning. However, through all this, he was engaged.

However, due to the rapid sound byte platform of these games, once we shifted to more informational text, to talking books on CDROM and to writing and creating stories, these platforms were slow for David. At first he didn't have the attention span to sit and create a story, to read through a book,

or to discuss what he was learning and the connections that it had to his life. Initially, his reactions were only one or two words, his attention was very short, and his follow through and connections to other learning were non-existent. However, we persisted.

Talking Books on CDROM

The first books that we introduced to David were folk tales. We chose these because folk tales are formulaic, relate a story which has a moral or main point that is blatant and characters are flat and stereotypic. David is also trying to sort out what is true and what is not true. And so the exaggerations used in folk tales are blatant enough that David began to understand the exaggerations as being untrue. When reading through Pecos Bill, Paul Bunyan and Johnny Appleseed David's first reads were quick and with no discussion. He only wanted to listen to the sound reading. We had to scaffold heavily to get him to retell any of the story. He chose a small part to retell and used only one sentence.
Examples:

"'bout a boy who falls out of a wagon." (Pecos Bill)
"It's a big man." (Paul Bunyan)
"Johnny planted seeds." (Johnny Appleseed)

Building Schema

At this point, we introduced the software piece called *Inspiration* which allows children to build schema of story through pictures, words, and sentences. Then it will transform the map into a linear outline form if asked. However, this schematic platform greatly helped David to begin to understand how a story can develop.

David's first map of Johnny Appleseed had the following words and pictures: Johnny, appleseed, traveled, planted, house. He drew a picture of Johnny, the seed, the house and trees. Compare this to three months later (May) when he wrote the following with *Inspiration* and illustrated it. "Paul Bunyan. When he was a baby he was so big that he had a cradle that rocked him by floating on the water. When the cradle rocked it made big waves. The waves crashed onto the land and into houses. People were angry." During the reading of this story David asked us to write the following words; houses, waves, grew, baby, cradle, rocked. These were the words that he incorporated into his story. It should be noted that David's handwriting is very labored and difficult to read. Thus, through writing on the computer, David is better able to read and write his own words.

During the first four months, we worked with talking books on CDROM, with *StoryWeaver*, and with Inspiration. During the fall semester, we continued those platforms, but a new CDROM which became extremely successful with David. Edmark has published thematic areas which allows students a virtual reality of oceans, pyramids, rainforest, and neighborhoods. Because of the perseverance of the autistic learner, David has become obsessed with mummies, pyramids, and treasures. Thus, the software, in addition, to books (Aliki, 1979) with explicit diagrams of pyramids, drawings, writings expanded his study and readings of ancient Egypt.

In addition, to reading, writing, and investigating the Egyptian culture, David has also begun to investigate his own feelings and ask questions. "How is his God different from the Egyptian gods?" "What will happen to him when he dies?" "Will he be a mummy, too?" Of particular interest to him were the beliefs of passing into heaven or hell. In Egypt he learned that the two biggest sins were to build a dam and to harm or kill a person. David talked about the things that bad boys did and the things that good boys did in comparison. He has very literal reasoning regarding these rules. However, through comparisons, he is learning that different people do believe different things and that is acceptable. They are just different from him.

David's mother is a wonderful mother and tries to contextual all David's learning for him. She also believes in the importance of experiences that can help David learn. She provides trips and visits to special events. Along with these activities, she builds learning environments for David like collecting artifacts, books, pictures, and brochures. Each time David comes into our office, he brings something to talk about. Last summer the family went to Galveston and collected shells. David's mother helped him classify his shells and mount them in a special box with labels. He brought these to me and we digitized the pictures and created a story through Inspiration.

David at Galveston

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> Last summer David went to the beach in Galveston. David collected many shells. Some were very little and some were big. Some were pink, some were gray and some were white. Some still had animals in them. David likes to collect shells.

These stories are language experience stories for him and provide practice each time for reading and writing. He takes them home and reads them to his father and mother. He also takes them to school to read them to his class.

Assessment Results

In addition to the stories that David reads and writes each time, the Woodcock Johnson Reading Mastery Test was administered in February and May to help us see the growth that he made when he is compared to a norming group. Because the norm group comparisons are meaningless (they only tell us that he is below his age norming group) we will instead look at raw data for qualitative differences.

The pretest word identification (words in isolation) David's score grew from 26 to 31. However, word comprehension and passage comprehension nearly doubled. Word comprehension grew from 12 to 20 and passage comprehension grew from 10 to 18. David learned that words make sense and so he always looks first for meaning before he attacks a passage. These scores also indicate how important contextual learning is for his literacy growth. Words in isolation mean very little to him. The interesting subtest was the word attack subtest which is a test of pronunciation of nonwords. In both the pre and post tests his score remained zero. On the pretest he listened and when the explanation told him that these were not really words, he responded, "I can't read those. They are not words." (He definitely is smarter than we are!) On the post test he took each word and tried to make a real word out of it because he know that reading and words always make sense. The words he chose were orthographic similarities. (din as desert; ig as log; dat as did; tay as tie). David is secure with about a 200 word high frequency count, however. And his use of rhyme is improving with the constant work of onset and rime each time as he builds a word family word wall.

Probably the most significant growth has been with his writing. At the first of the year, he was unable to develop any story structure at all. His stories were only words. Now, he is able to think in terms of cause and effect and outcomes. He summarizes and paraphrases. His stories are coherent and full of meaning although lacking in rich detail.

Discussion

For this study we've drawn upon the theoretical structure of Piaget, Vygotsky, and Werner. From Piaget we know that scheme is what is repeatable and generalizable. The hypermedia platform offers David unlimited repetition, the schema to build a structure for story and information through main ideas and details, and the links to areas that he knows and wants to know more about. Through simulations of pictures, sound voice, and motion, David is shown representations that are real to him. Vygotskian theory would indicate that hypermedia represents a platform that can scaffold learning within his zone of proximal development as well as linking multiple ways of representing thought connections. Werner would argue that hypermedia represents the ability to represent shifting points of view and concrete relatedness that will enable the autistic learner to come at learning through multiple symbolic representations.

Conclusions

David's literacy learning with the hypermedia platform grew in many dimensions. He became able to tell a story from beginning to end. Before he only would tell specific events or facts that were meaningful to him. Now he will write a story which has a focus. Before, there were many disconnected sentences with unrelated ideas even within a sentence. However, the most dramatic shift has been with David's attention to literacy growth. Initially, David would only tell me words to write. Now he chooses his words from the story he reads. He asks many questions. We talk and make connections to what he already knows. He builds ideas, examples, and connections based upon his learning. He uses the computer to gather information, to store information, to organize information, and then to write his own reflections and responses. Hypermedia is the perfect platform for his literacy growth because of the multidimensional way he can represent his own thoughts and language. Through Hypermedia David can learn and build literacy links far beyond those that are provided with only paper, pencil and books.

Through David's explorations into Hypermedia, he controls the construction of meaning in ill-structured domains by guiding himself through nonlinear, multidimensional explorations of language and learning.

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